JOINT EUROPEAN RESEARCH INFRASTRUCTURE NETWORK FOR COASTAL OBSERVATORIES

JERICO WP3+4:
BEST PRACTICE-FERRYBOX

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BACKGROUND

- *11 years of operation of the Norwegian Network*
- *9 different ship installations over 11 year*
- *5 different ship companies over the periode*
- *Norwegian Network operates from 54.5 to 79.5 North*
- *2 Ferrybox systems in operation with the NIVA standard system*
  - *Temp, T-Inlet, Sal,O2, Chl-a_Fl, Turbidity, water sampler (24 *1 L)*
- *1 Ferrybox with standard systems + experimental systems*
  - *CDOM, Phycocyanin, Enviro-Flu(PAH), pCO2, passive sampler air pressure and pH (soon)*
- *All 3 have TriOS Ramses radiance sensors for satellite validation*
- *2 Minor Ferrybox systems with only Temp, Sal, Chl-a_Fl*

CONTENT

- *Installation of a new Ferrybox system (D3.1)*
- *Data transmission and communication*
- *Maintenance of the systems*
- *Calibration and QA-controls of the systems*
- *Calibration of Chl-a fluorescence*

DELIVERABLE D3.1

Report on current status of Ferrybox
D 3.1

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Project Acronym: JERICO

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INSTALLATION

- *Ship company/owners*
  - *Good relation with all involved – technical inspector/director*
  - *Good information, benefit for the company*
    - *«Green profile»*
    - *Web display to passenger*
    - *Data can be helpful for the ship (temp, density, alkalinity)*
  - *You should consider if possible the «stabilty of the company»*
- *Ship type*
  - *Normally not many to choose since you want a certain area/transect*
  - *Ferries or cargo ships? Whats most stable concerning the operation*
  - *Cargo ship more rolling than ferries. (Optical measurements from deck)*
  - *Cargo more variations in water depth on intake and air in ship chest*

INSTALLATION

- *Route*
  - *Long routes give less access and service*
  - *Long port calls is not cost effective and can give more biofouling*
  - *Short port calls less possibility for service*
- *Regulations*
  - *Depends of the ship type and must be considered*
  - *Some area on the ship can have stronger regulation (IP-class, air gas under pressure e.g.)*
- *Place for installation/working space*
  - *Air temperture, air pollution/oil in the atmosphere*
  - *Space for specific experiments*
  - *Distance to the water inlet*

INSTALLATION

- *Water inlet/outlet*
  - *Water from ship chest or separate inlet (docking needed)*
  - *Water from the internal water cooling (biofouling chemicals-problem?)*
  - *Possibilities to clean the inlet and outlet*
    - *Use ball valves – easy to clean*
  - *Place for separate inlet temp and oksygen (before the debubbler)*
  - *Regulation depending on ship and operation area*
  - *Water supply lines - regulations*
- *Pump(s)*
  - *Choose depend on the Ferrybox systems and what you are measuring*
  - *Biological samples (phytoplankton countings, flow cytometry) need maybe a slow moving peristaltic pump*
  - *Use pressure- and vakuum controller to stop pump if blocking*

INSTALLATION

- *Choice of the Ferrybox system*
  - Commercial available Ferrybox systems and institute developed systems
  - Some arguments to consider:
    - Risk of leaks and flooding.
    - Open system water outlet (need to pump out).
    - Is the range of sensors and their accuracy what you need?
    - Can a third party system fit in the allocated place?
    - Can one split in smaller parts and remounted in the ship?
    - Can extra sensors be added in the future?
    - How “open” is the system hardware and software?
    - Data from the ship’s system to be included (GPS, Wind, Gyro)?
    - Is it possible to modify settings and software using an external communications link to the ship from shore?

DATA TRANSMISSION AND COMMUNICATION

- *Internally on ship:*
  - *RS232 Port server between sensor and computer*
  - *IP communication from deck sensor to Ferrybox computer*
  - *Access to the ship GPS , Gyro, wind sensor.*
  - *Send data from the Ferrybox to the bridge (display)*
  - *(W)LAN (internal internet on deck)*
- *Externally to database at NIVA*
  - *GPRS must be used on ship in the Barents Sea*
  - *Prefere to use ships internet communication*
- *Software*
  - *LabView*
  - *PC-anywhere*
  - *TeamViewer can be operated from iPad and iPhone*

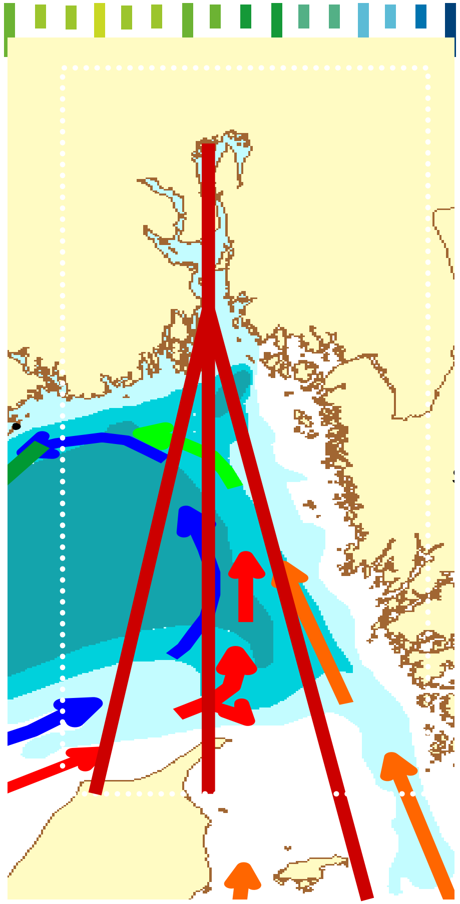
MAINTENANCE

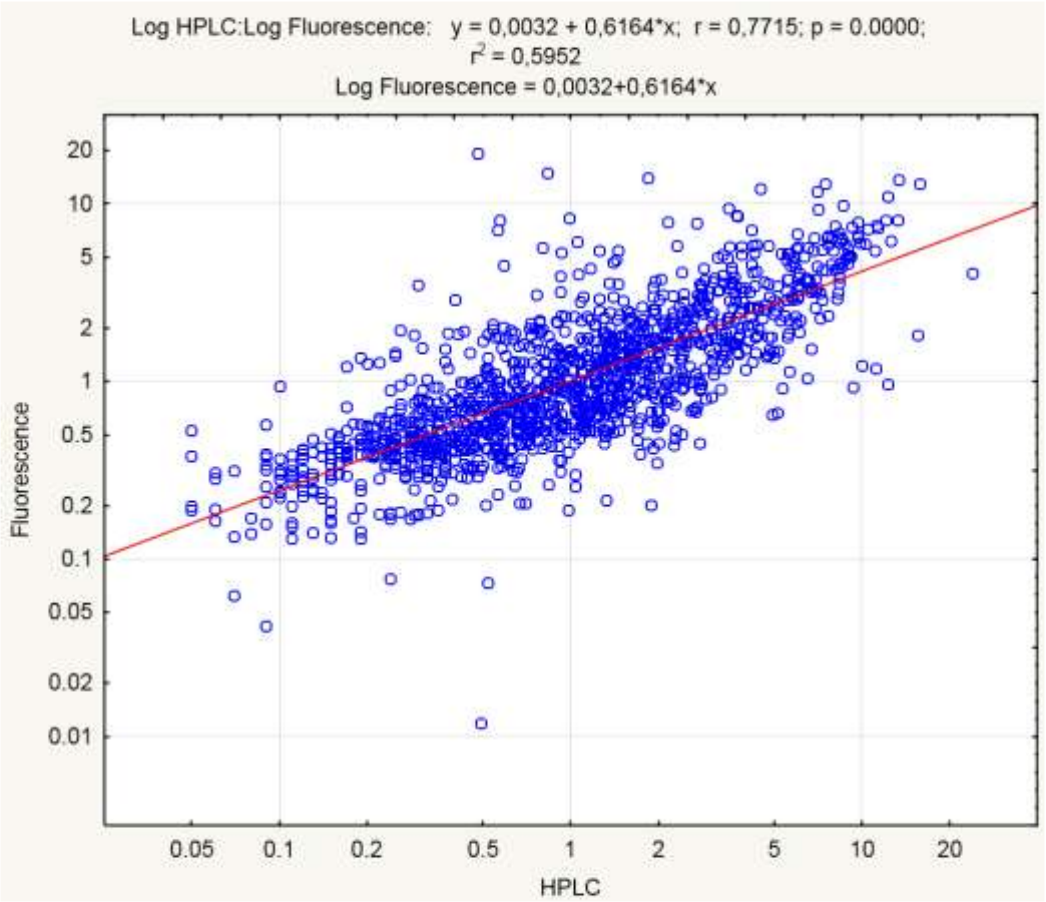
- *High pressure air cleaning in every port visit*
  - *From 2 to 35 port stops for one trip*
  - *From 4-6 hours to max 48 hours*
- *Manual cleaning in start and end harbour*
  - *Weekly to monthly frequence*
  - *Acid cleaning when needed*
  - *Inlet and outlet valves 2-3x year*
- *Optical deck sensor*
  - *3-4x/year inspection and cleaning*

CALIBRATION AND CONTROLS

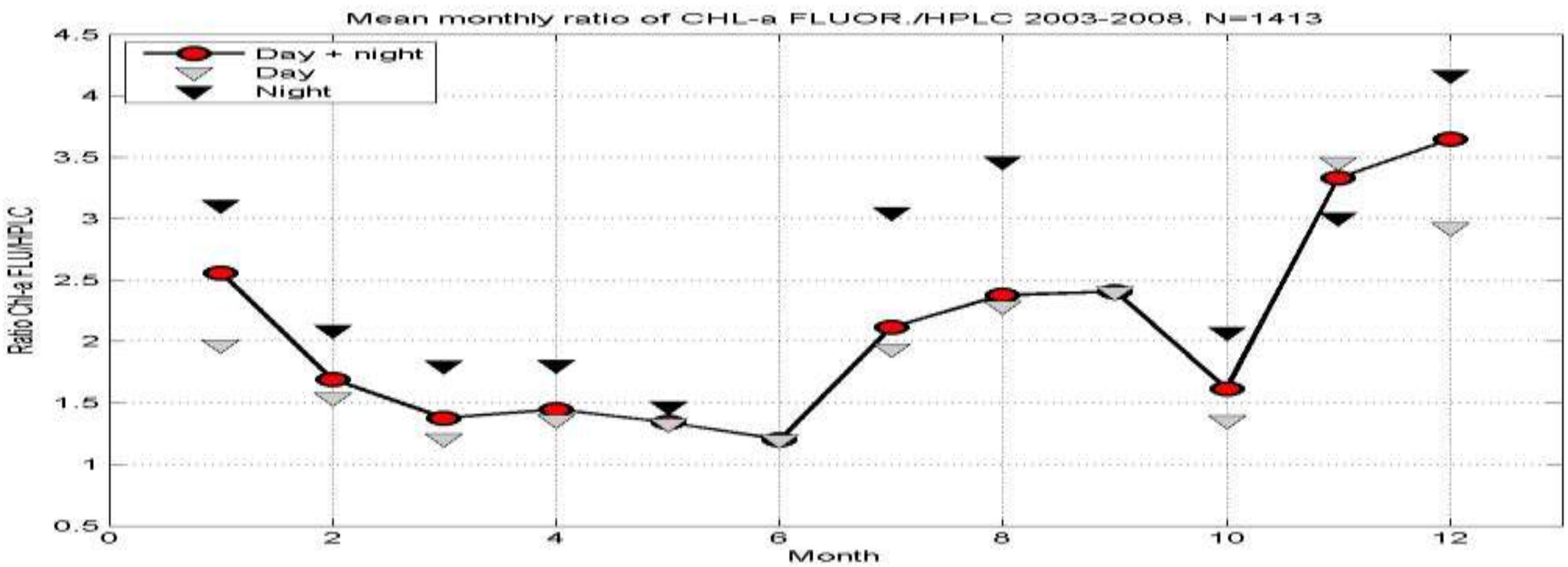
- *Salinity/temperature*
  - *Certified digital term./Control samples minimum 2-4x/year*
  - *Factory calibration when needed (every 2 years)*
- *Oxygen*
  - *Winkler (in harbour/at sea) 4-6x/year*
- *Turbidity*
  - *Formazin turbidity standards 1x/year*
  - *Formazin prepared in house and calibrated according to ISO-EN 7027*
- *Irradiance/radiance sensor*
  - *FieldCal lamp 3-4x/year, Yearly control at NIVA - NIST reference lamp*
  - *Factory or external calibration when needed*
- *Chlorophyll-a fluorescence*
  - *Algal culture yearly (Skeletonema Costatum, exponential growth)*
  - *«Field calibration» Chl-a (hplc) water samples monthly/weekly*
  - *Seasonal calibration*
  - *Sensor drift control with solid standard introduced from October-12*

CHL-A_FL VS CHL-A_HPLC FOR 6 YEARS OF DATA IN THE SKAGERRAK





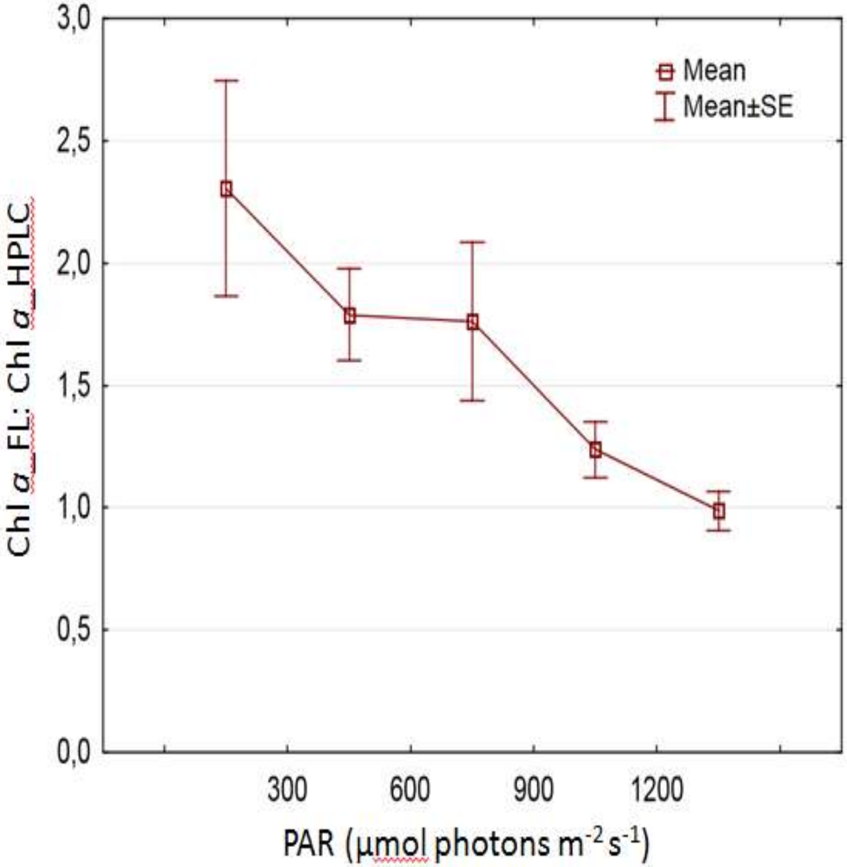
FerryBox seasonal and night and day variation



- *Most months show the same trend:*
  - *High ratio at night*
  - *Lower ratio at daytime*

Yearly calibration of the Chl-a fluorescense using all the Chl-a_hplc water samples

CHL-A_FL / CHL-A (HPLC) VS PAR MEASURED AT DECK



- *Dependency of the downwelling irradiance*
- *Recommendation to start measure PAR*
- *Modelling of the Chla_a_fl/Chl-a_conc ratio on seasonal basis*
- *Goal: To improve the Chl-a_fluorescence as a proxy for Chl-a*

SUMMARY

- *A good planned technical installation and choose of system are important for the operation, maintenance costs and data quality*
- *Internet communication are a preferable for the operation to be able to access the system*
- *Maintenance depends much of the system in operation and the access to the installation*
- *Sensorcalibration and controls are of high importance and must follow the agreed protocols*
- *Chl-a fluorescence as a proxy for Chl-a can be improved using seasonal calibration of the Chl-a_fl/Chl-a ratio.*